Grid Planning and Development - Target 40

Contract #: 500-00-023 **Project #:** 18
Contractor: Electric Power Research Institute (EPRI)
Subcontractors: Best Systems, Inc.: Decision Systems International: Electricite de France: EPRIsolutions: P Plus Corporation: Southern Company Services, Inc.: Vanessa MacLaren-Wray, dba
Project Amount: $98,077
Match Amount: $4,282,593
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Status: Completed

Project Description:
The purpose of this project is to increase the speed and efficiency of planning tools. Grid planning cycles today in California and throughout North America are continually being compressed. To make effective decisions under these conditions, power system planners need tools that allow them to rapidly obtain and process information, solve complex problems, and, in some cases, provide a sound business justification for their decisions. In addition, planners must often seek to maximize the value of their power grid assets while at the same time maintaining system reliability.

EPRI products in this area are designed to meet new grid planning needs in California and elsewhere by increasing the speed and efficiency of planning tools. For example, one product will help planners take advantage of advances in grid operations tools by improving capabilities for sharing real-time data with grid operations applications. Other products are increasing capabilities of existing software for simulation and analysis of grid conditions. EPRI is also strengthening capabilities for evaluation of grid security and providing new tools for conducting cost/benefit studies. The one-day workshop sponsored by this target in association with the Energy Commission provided a large public forum for evaluation of alternative wholesale market structures for California.

This project supports the PIER Program objectives of:

- Improving the reliability/quality of California's electricity through innovative technologies, which help to balance the competing needs of maximizing the use of the grid while maintaining the security of the system.
- Improving the energy cost/value of California's electricity by merging new tools for grid functionality with information for operating in the new competitive marketplace. EPRI technology development programs will help to increase transmission capacity across constrained interfaces, thus reducing grid-operating costs, while enhancing system security.

Proposed Outcomes:

1. Develop and upgrade grid planning software and methods to increase the speed and efficiency of their analytical capabilities and improve their ease of use.
2. Enhance grid planning software used for assessing transmission system reliability.
3. Improve grid planning software with capabilities for cost/benefit analyses of network additions and constraints.

4. Conduct a co-funded project entitled “Workshop on Exploring Alternative Wholesale Market Structures for California.”

Actual Outcomes:

1. Improve Software Efficiency and Ease of Use.
   - Two mainline planning applications—IPFLOW and DYNAMICS—were integrated with a database compliant with the Common Information Model (CIM), enabling these planning applications to utilize real-time operating data and share data with operators.
   - New computational techniques to increase analysis speed were developed for a restructured version of the Electromagnetic Transients Program (EMTP), a software widely used for simulating and identifying solutions for high-speed transients. *Restructured Electromagnetic Transients Program Progress Report: (EMTP-RV) (1001989).*
   - Object-oriented technology was applied to the Power Systems Analysis Package (PSAPAC) software, which will increase the processing efficiency and substantially reduce the cost of development.
   - Version 6.0, incorporating an improved graphical user interface, was developed for the Interactive Power Flow (IPFLOW) program, which supports a family of planning applications, including ETMSP, VSTAB, and SSSP.
   - Version 2.0 of EPRI’s GOP Graphics System was developed, providing a standard graphical user interface for all EPRI grid planning applications.
   - Software support was provided to users of EPRI’s grid planning and development software, including ongoing distribution and maintenance, user group support, and software enhancements.
   - A triannual newsletter was published on new software programs and methods for improved transmission grid planning.
2. Strengthen Capabilities for Reliability Assessment.
   - A report –*Restructured Transmission Reliability Evaluation for Large-Scale Systems (TM) (TRELSS (TM)): An Implementation Plan (1001987)* - was published on progress in upgrading EPRI’s Transmission Reliability Evaluation for Large-Scale Systems (TRELSS)—commonly used for assessing reliability of bulk power systems—to update its computational techniques, GUI, database management, and use of object-oriented technology.
   - A report - *Modeling and Diagnosis Methods for Large-Scale Complex Networks: EPRI/DoD Complex Interactive Networks/Systems Initiative: Second Annual Report (1006092)* – was published that presents progress on modeling and diagnosis methods for large-scale complex networks.
   - A report - *Intelligent Management of the Power Grid: An Anticipatory, Multi-Agent, High Performance Computing Approach: EPRI/DoD Complex Interactive Networks/Systems Initiative: Second Annual Report (1006091)* – was published that describes the progress made in understanding the grid as a customer-driven, anticipatory system.
   - A report - *Minimizing Failures While Maintaining Efficiency of Complex Interactive Networks and Systems: EPRI/DoD Complex Interactive Networks/Systems Initiative: Second Annual Report (1006093)* - was published that discusses minimizing failures while maintaining efficiency of complex interactive networks and systems.
   - A report - *Context-Dependent Network Agents: EPRI/DoD Complex Interactive Networks/Systems Initiative: Second Annual Report (1006094)* - was published that presents progress on developing and demonstrating "context-dependent network agent" (CDNA) technology.

- A report - *From Power Laws to Power Grids: A Mathematical and Computational Foundation for Complex Interactive Networks: EPRI/DoD Complex Interactive Networks/Systems Initiative: Second Annual Report (1006095)* – was published that focuses on understanding the behavior of large-scale complex interactive networks and investigating their mathematical underpinnings.

3. Enhance Capabilities for Cost/Benefit Analyses.
   - Version 5.0B of EPRI's DYNATRAN software (1001988)—which models economic costs and benefits of network constraints and additions—was developed, providing new computational capabilities.
4. Conduct Workshop on Alternative Marketing Structures.
   - EPRI facilitated a 1-day workshop on November 7, 2001, to explore alternative power market structures for California. The workshop created a large public forum that featured two presentations on new research, three panel discussions with experts from throughout the state, and an audience of about 100 attendees representing a broad cross-section of industry interests.

Project Status:
The project has been completed.